PK DiGiTaL

BIODIVERSITY

& ITS CONSERVATIONS

THE BEST WAY TO PREDICT THE FUTURE IS TO CREATE IT.

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BIODiversity & ITS Conservation

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- The wealth of knowledge is the supreme wealth of all -

The vernier caliper is your gateway to precision, transforming tiny measurements into exact science with ease and accuracy

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Biodiversity : Biodiversity refers to the variety and variability (i.e. different kinds) of life on earth, including everything from tiny microorganisms to plants and animals. It also includes the ecosystems where they live. Biodiversity is very important because it helps ecosystem work properly and gives us essential things like food, medicine, and materials.

→It means the variety of life on earth, including all plants, animals, microorganism, and ecosystems.
→ It incompasses all forms of life, from genetic variations to entire ecosystems.
→ It can be defined as the totality of genes, species and ecosystem in a particular region.

From a Story : Imagine a rainforest : Tall(big) Trees, small(tiny) insects, colourful birds, and even mushrooms growing in the soil. All of these living things from the smallest ant to the largest elephant are part of biodiversity.

★ Types of Biodiversity :

1. Genetic Diversity : Genetic diversity refers to the variety of genes within a single species. (e.g, different types of rice)
Long Definition : Genetic diversity refers to the differences in genes within the same species. These variations help species adapt and survive in changing environments.
From a story : Thinks a dogs from small chihuahuas(variety of dog) to large Great Danes(Variety of dog). They are all dogs but look and behave differently because of genetic diversity.
From a story : In agriculture different varieties of rice plants have differnet genetic traits. Some are more resistant to drought while others can withstand pests by preserving genetic diversity, farmers can choose the best varieties from different conditions, helping ensure food security.

→ **Types of Genetic Diversity :**
(i) Within-Population Diversity : Within-population diversity refers to the genetic differences among individuals within the same population of a species. This variation can affect various traits, such as physical appearance, behavior, and adaptability to the environment.
From a story : A population of butterflies may have different color patterns and wing shapes due to genetic differences.

(ii) Between-Population Diversity : It refers to genetic differences between separate populations of the same species.
From a Story : Imagine two populations of the **same plant species**—let's say wildflowers. One population grows in a sunny, dry area, while another population thrives in a shady, moist forest.

- **Wildflowers in the Dry Area**: These plants might have adapted to conserve water, resulting in smaller leaves and deeper root systems.
- **Wildflowers in the Moist Forest**: In contrast, the plants in the forest may have larger leaves to capture more sunlight in their shaded environment and shorter roots because water is more readily available.

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(iii) Total Genetic Diversity : It includes all the different genes within a species, combining both the variations within a population and between different populations.

- **Within-Population Diversity :** In one lake, fish show various colours and sizes due to genetic differences within that population
- **Between-Population Diversity :** In another river, fish may have evolved streamlined bodies to swim better in the flowing water.

(iv) Molecular Diversity : It means the differences in DNA and genes within and between populations. For examples, different versions of a gene can change traits like colour or disease resistance in a species.

(v) Functional Diversity : it is the variety of genetic traits that influence how organisms operate in a ecosystem, such as(example) some fish being able to survive in low oxygen water, while others do not. The diversity is important for the health and stability of ecosystem.

2. Species Diversity : Variety of species in an area (e.g, many species of birds in a forest)
Long Definition : Species diversity means the variety of different species in a particular area(specific area) or ecosystem. It is important for a healthy and balanced environment.
From a story : A great example of species diversity can be found in a **coral reef**. In a coral reef, you can find many different species, including:

- **Fish**: There are colorful clownfish, big parrotfish, and even graceful butterflyfish.
- **Corals**: Different types of corals provide homes for fish and other sea creatures.
- **Invertebrates**: There are also various species of starfish, sea urchins, and crabs.

Types of Species Diversity :

1. **Richness**:
   The number of different species in an area. For example, a rainforest has many different plants and animals.
2. **Evenness**:
   How equal the number of individuals is among different species. A balanced ecosystem has many species with similar numbers.
3. **Alpha Diversity**:
   This measures the diversity within a particular area or ecosystem. The variety of species within a specific area or habitat.
4. **Beta Diversity**:
   The differences in species between two or more ecosystems. High beta diversity means the areas have different species.
5. **Gamma Diversity**:
   The total diversity of species across a larger region that includes multiple habitats.

3. Ecosystem Diversity : Variety of ecosystem (e.g, forests, oceans, deserts, etc.)
Long Definition : Ecosystem diversity means the variety of different ecosystems in an area. Each ecosystem, like forests, grasslands, wetlands, and coral reefs, has unique plants, animals, and processes.

Importance:

- Resilience: Diverse ecosystems can adapt better to changes, like climate shifts.
- Resources: They provide food, water, and materials for life.
- Habitat: More ecosystems mean homes for a wider range of species.

Examples:

1. Forests: Tropical rainforests and temperate forests.
2. Grasslands: Savannas and prairies.
3. Wetlands: Marshes and swamps.
4. Coral Reefs: Underwater habitats with many fish and corals.
5. Deserts: Dry areas with special plants and animals.

Long Examples :

1. **Forests**:
    - **Tropical Rainforest**: A dense forest near the equator with tall trees, colorful birds, monkeys, and many plants. Examples include the Amazon Rainforest.
    - **Temperate Forest**: A forest with seasons, where trees lose their leaves in fall. You can find deer, squirrels, and various bird species. Examples include the forests in the eastern United States.
2. **Grasslands**:
    - **Savanna**: A grassy area with some trees, often found in Africa. It is home to animals like elephants, giraffes, and lions.
    - **Prairie**: A flat, grassy area in North America where you can find bison, prairie dogs, and many wildflowers.
3. **Wetlands**:
    - **Marsh**: A wet area with soft, wet soil, home to frogs, ducks, and tall grasses. Examples include the Florida Everglades.
    - **Swamp**: A wetland with trees and standing water, where you might see alligators and turtles.
4. **Coral Reefs**:
    - **Great Barrier Reef**: A large underwater ecosystem off the coast of Australia, full of colorful corals, fish, and sea turtles.

5. **Deserts**:
    - **Sahara Desert**: A vast dry area in Africa with sand dunes and cacti. Animals like camels and lizards live here.
    - **Sonoran Desert**: A desert in North America with unique plants like saguaro cacti and animals like roadrunners and scorpions.

Biodiversity Important :

1. **Healthy Ecosystems**:
   Biodiversity helps ecosystems work well. Different species have specific jobs, keeping nature balanced. For example, predators control prey populations, and plants provide food and oxygen. For example, wolves keep deer populations in check, which prevents overgrazing in forests.
2. **Food Supply**:
   Many types of plants and animals give us food. For instance, farmers grow rice, corn, and beans, ensuring we have plenty to eat.
3. **Medicines**:
   Many medicines come from plants and animals. Biodiversity gives us many options for finding new medicines and treatments. For example, the foxglove plant is used to make a heart medicine.
4. **Economic Benefits**:
   Healthy ecosystems support jobs and money through tourism, farming, and fishing. Biodiversity helps boost natural resources. Example: **Coral reefs** attract tourists for activities like snorkeling and diving, helping local businesses in places like the Great Barrier Reef in Australia.
5. **Climate Control**:
   Diverse ecosystems, like forests and wetlands, help absorb carbon dioxide and reduce greenhouse gases, which can help fight climate change. Example: The **Amazon Rainforest** is known as the "lungs of the Earth" because it absorbs large amounts of CO2, helping to reduce climate change.
6. **Cultural Importance**:
   Biodiversity is important for many cultures. Different plants and animals are part of traditions, stories, and art.
7. **Adaptability**:
   Diverse ecosystems can better handle changes like climate change, diseases, or disasters. More species mean better chances to adapt.
8. **Pollination and Soil Health**:
   Many plants need animals, like bees, to help them grow. Diverse species also improve soil health by breaking down waste and keeping nutrients in the soil. Example: **Honeybees** pollinate fruits like apples and strawberries, which are important for our diets. **Earthworms** improve soil health by breaking down organic matter, making the soil richer for crops.

Biogeographical Classification of India / Major Bio-geographical Zones of India :

Biogeographical classification refers to the way scientists categorize the Earth's regions based on their biological diversity, ecosystems, and the distribution of species. we group different regions based on their plants, animals, and environments. India has a rich diversity of life, and it can be divided into ten major zones:

1. Trans-Himalayan Region:
    - Where: Northern India, like Ladakh.
    - Climate: Cold and dry.
    - Animals: Snow leopards and Tibetan antelopes.
2. Himalayan Region:
    - Where: The Great Himalayas from Kashmir to Arunachal Pradesh.
    - Climate: Varies from warm in the foothills to very cold at the top.
    - Animals: Red pandas and Himalayan tahr.
3. Indian Desert:
    - Where: Mainly the Thar Desert in Rajasthan.
    - Climate: Very hot and dry.
    - Animals: Camels and desert foxes.
4. Semi-arid Grasslands:
    - Where: Parts of Rajasthan and Gujarat.
    - Climate: Moderate rainfall.
    - Animals: Antelopes and various birds.
5. Western Ghats:
    - Where: Mountain range along India’s west coast.
    - Climate: Tropical with heavy rains.
    - Animals: Nilgiri Tahr and Lion-tailed Macaque.
6. Deccan Peninsula:
    - Where: Central and southern India.
    - Climate: Varies, mostly warm.
    - Animals: Indian leopards and many birds.
7. Gangetic Plains:
    - Where: Northern India along the Ganges River.
    - Climate: Fertile and subtropical.
    - Animals: Gangetic dolphins and many farm birds.
8. Northeast India:
    - Where: States like Assam and Arunachal Pradesh.
    - Climate: High rainfall and humid.
    - Animals: One-horned rhinoceros and hoolock gibbons.
9. Coastal Regions:
    - Where: Eastern and western coasts of India.

- Climate: Tropical.
- Animals: Olive Ridley turtles and various seabirds.

10. Islands:
    - Where: Andaman and Nicobar Islands, Lakshadweep.
    - Climate: Humid and tropical.
    - Animals: Nicobar pigeons and colorful marine life.

Biodiversity Hotspots of India :

Biodiversity hotspots are places where many different plants and animals live, but they are also at risk because of human activities. India has four main biodiversity hotspots:

1. Western Ghats

- **Location**: Along the western coast of India, from Maharashtra to Tamil Nadu.
- **Importance**: Home to many plants and animals, like the **Lion-tailed Macaque** (a monkey) and **Nilgiri Tahr** (a mountain goat).
- **Threats**: Deforestation (cutting down trees), urbanization and climate change.

2. Himalayas

- **Location**: In northern India, from Jammu and Kashmir to Arunachal Pradesh.
- **Importance**: Rich in many plant species and animals like the **snow leopard** and **Himalayan black bear**.
- **Threats**: Habitat loss (losing homes), climate change and poaching..

3. Indo-Burma Region

- **Location**: Northeastern India and parts of Southeast Asia.
- **Importance**: Home to many unique plants and animals, such as the **Bengal tiger** and **Indian elephant**.
- **Threats**: Deforestation, agriculture expansion, and human-wildlife conflict.

4. Sundaland (Nicobar Islands)

- **Location**: The Nicobar Islands.
- **Importance**: Contains unique animals like the **Nicobar pigeon** and rich marine life (fish and corals).
- **Threats**: Habitat destruction due to tourism, invasive species, and climate change.

Importance of Biodiversity Hotspots :

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- **Conservation Priorities:** These hotspots are essential for global conservation efforts because they contain a large number of species, many of which are endangered.
- **Ecosystem Services:** Hotspots provide vital services such as clean water, pollination(helping plants grow), and carbon storage.
- **Cultural Significance:** Many indigenous(local) communities rely on these ecosystems for their livelihoods and cultural practices.

Threats to Biodiversity

Biodiversity, or the variety of life on Earth, is facing serious threats from human activities. Here are the main threats:

1. Habitat Loss

- **What it is**: Habitat loss happens when natural places where animals and plants live are destroyed or changed.
- **Causes**:
    - **Deforestation**: Cutting down forests for wood, farming, or building cities.
    - **Urbanization**: Expanding cities take over natural areas.
    - **Farming**: Turning forests and grasslands into farmland reduces space for wildlife.
- **Impact**: Many animals and plants lose their homes, which can lead to fewer of them and even extinction. For example, **tigers** are endangered because their forest homes are disappearing.

2. Poaching of Wildlife

- **What it is**: Poaching is the illegal hunting of animals for their parts, like fur, horns, or meat.
- **Causes**:
    - **High Demand**: People want items like elephant tusks, rhino horns, and tiger skins for money.
    - **Weak Laws**: Not enough protection for wildlife makes it easier for poachers to succeed.
- **Impact**: Poaching reduces the number of certain animals and can lead to extinction. For example, the **Indian rhinoceros** is endangered because people hunt it for its horn.

3. Man-Wildlife Conflicts

- **What it is**: Conflicts happen when wild animals come into contact with people, often leading to problems for both.
- **Causes**:
    - **Humans Taking Land**: As people move into animal habitats, animals may eat crops or livestock, leading to angry farmers.
    - **Sharing Resources**: Animals may compete with people for food and water.
- **Impact**: These conflicts can result in animals and livestock getting hurt or killed. For instance, **elephants** can be killed when they eat crops from farms.

Endangered and Endemic Species of India

Endangered Species :

Endangered species are animals and plants that are at risk of disappearing forever. Here are some important endangered species in India:

1. **Bengal Tiger**
    - **What it is**: India's national animal, known for its beautiful stripes.
    - **Threats**: Losing its habitat and being hunted for its skin.
2. **Indian Rhinoceros**
    - **What it is**: A large animal with a single horn.
    - **Threats**: Hunted for its horn and losing its home due to farming and development.
3. **Snow Leopard**
    - **What it is**: A big cat that lives in cold mountains.
    - **Threats**: Losing its habitat and being hunted for its fur.
4. **Ganges River Dolphin**
    - **What it is**: A unique dolphin that lives in the Ganges River.
    - **Threats**: Pollution and getting caught in fishing nets.
5. **Great Indian Bustard**
    - **What it is**: A large bird known for its impressive size and dance.
    - **Threats**: Losing its habitat and hunting.

Endemic Species :

Endemic species are plants and animals that are found only in a specific place. Here are some important endemic species in India:

1. **Nilgiri Tahr**
    - **What it is**: A mountain goat found in the Western Ghats.
    - **Importance**: Helps keep the mountain ecosystem healthy.
2. **Lion-tailed Macaque**
    - **What it is**: A monkey with a mane, found in the Western Ghats.
    - **Importance**: Helps spread seeds in the forest.
3. **Western Ghats Flying Frog**
    - **What it is**: A unique frog that can glide between trees.
    - **Importance**: Adapted to live in the forests of the Western Ghats.
4. **Andaman Wild Pig**
    - **What it is**: A wild pig that lives only in the Andaman Islands.
    - **Importance**: Represents the unique wildlife of these islands.
5. **Nicobar Pigeon**
    - **What it is**: A colorful pigeon found only in the Nicobar Islands.
    - **Importance**: Important for the health of the island ecosystem.

Conservation of Biodiversity: In-Situ and Ex-Situ Conservation

Conserving biodiversity is important to protect the variety of life on Earth. There are two main ways to do this: **in-situ** and **ex-situ** conservation.

1. In-Situ Conservation :

- **What it is**: Protecting species in their natural homes (habitats).
- **How it works**:
    - **Protected Areas**: Creating national parks and wildlife sanctuaries to keep animals and plants safe.
    - **Habitat Restoration**: Fixing damaged habitats to help wildlife thrive.
- **Benefits**:
    - **Natural Environment**: Animals and plants live in their own natural surroundings, which is best for them.
    - **Ecosystem Balance**: Helps keep the balance of nature, which is important for all living things.

- **Example**: **Kaziranga National Park** in Assam protects the Indian rhinoceros and many other species.

2. Ex-Situ Conservation :

- **What it is**: Protecting species outside of their natural habitats.
- **How it works**:
  - **Zoos and Aquariums**: Keeping animals and plants in safe environments where they can be cared for and bred.
  - **Seed Banks**: Storing seeds from endangered plants to use later for planting.
- **Benefits**:
  - **Safety from Threats**: Protects species from dangers like poaching or losing their homes.
  - **Research Opportunities**: Scientists can study these species to learn how to help them better.
- **Example**: The **Indian Crocodile Conservation Project** breeds crocodiles in captivity and releases them into the wild to help increase their numbers.